Irradiation Treatment of Lymphoid Hyperplasia of the Nasopharynx

JAMES B. IRWIN, M.D., *San Diego*

SUMMARY

Irradiation is useful in the destruction of hypertrophied lymphoid tissue which cannot be surgically removed.

Beta, gamma and roentgen rays have been used for this purpose. With beta rays, surface tissue must be subjected to relatively high dosages if effective radiation is to be delivered to deeper-lying tissues. This disparity is less when gamma rays are used, less still in the case of x-rays.

With the possibilities of permanent damage considered, choice of method depends upon the location and extent of the excess lymphoid tissue to be destroyed and the mechanical difficulties of reaching it with effective irradiation without hazard to intervening or surrounding tissue.

IN the past ten years irradiation of the nasopharynx has become a widely used method of reducing excess lymphoid tissue. Lederer[7] pointed out that the method was used to a great extent during the 1920's but then in most places was abandoned. Surgical removal of excess nasopharyngeal lymphoid tissue has been done for years. However, it is often impossible to remove all of the lymphoid tissue at operation, especially that lying around the orifice of the eustachian tube and that in the fossa of Rosenmuller. Also, sometimes there is regrowth of lymphoid tissue following operative removal. It was for the purpose of removing this excess lymphoid tissue after operation that irradiation methods were developed, and irradiation has been used successfully for this purpose for almost 30 years. Originally x-rays and gamma rays were used. Crowe[9] and his associates have used radon or beta irradiation for many years. During World War II Crowe helped design a beta radium applicator in order to permit treatment of more patients than was possible with the radon applicator because of the deterioration factor.

Irradiation of the nasopharynx is used in cases of impaired hearing and of chronic upper respiratory infection. Crowe and his associates have done a large amount of work in this field and are probably responsible for the widespread use of the monel radium applicator. They have expressed the belief that obstruction of the orifice of the eustachian tube by hypertrophied lymphoid tissue is an underlying factor in many cases of impaired hearing and that, if the condition is not relieved, permanent damage may result.

Presented before the Section on Eye, Ear, Nose and Throat at the 79th Annual Session of the California Medical Association, April 30-May 3, 1950, San Diego.

There are considerable differences among the various types of irradiation. The beta radium applicator, which is the most recent innovation, does not have as high an output as the radon applicator due to the filtration by the radium salt in the plaque.

Table 1 shows the roentgen equivalent delivered at various depths by the 50 mg. beta radium monel applicator. These data were presented by Braestrup[1] at the 1949 meeting of the Academy of Otorhinolaryngologists. Since that time, measurements have been made on other 50 mg. nasopharyngeal radium monel applicators similar in construction to the one used in Braestrup's study. Variations in the dosage rate, at the surface, between individual applicators were of the order of 15 per cent. It will be noted that the surface in contact with the applicator receives an extremely large dose, while 5 mm. away only one-sixteenth of the surface dose is delivered and at 10 mm. one seventy-fourth is delivered. Crowe[3] pointed out that the erythema dose delivered by the radium applicator in the nasopharynx is not the same as the erythema dose delivered to a flat surface, such as the skin, where an erythema dose is ordinarily determined. The contour of the nasopharynx is irregular and only half of the length of the applicator touches the mucous membrane. The points at which the applicator does touch the surface must receive intense irradiation.

TABLE 1.—*Roentgen Equivalents Delivered by Beta Radium Monel Applicator*

Depth mm.	Equivalent Roentgens for 1 min.	12 min.	36 min.
Surface	370	4,450	13,300
0.5	225	2,700	8,100
1	168	2,020	6,050
2	96	1,152	3,460
3	58	696	2,088
4	36	432	1,296
5	23	276	830
10	5	60	180
20	1.3	14.4	43

Bilchick and Kolar[2] observed some redness and edema following 12-minute exposure with the beta applicator. They believe that the reason they have noted reactions in a greater percentage of cases than have other investigators is that they are very careful to shrink the turbinates before inserting the applicator so that it may be pushed well over to the lateral side of the nasopharynx. Bilchick and Kolar observed that the highest intensity of reaction occurred between the 11th and the 13th day. (Their observation corresponds with the author's experience.) Because of these reactions, they have shortened the exposure time to nine minutes and increased the interval between treatments to three weeks.

Table 2 shows the amount of radiation reaching different depths when using gamma rays, that is, a 50 mg. applicator with 0.5 mm. platinum filtration. This method of treatment is not as widely used as the beta ray, probably because it is necessary to treat the patient for approximately one hour at each

TABLE 2.—*Radiation at Various Depths When Using Gamma Rays*[10]
(50 mg. Radium Applicator with 0.5 mm. Platinum Filter)

Depth	Equivalent Roentgens for— 30 min. = 25 mg. hr.	60 min. = 50 mg. hr.
1 mm.	1,125	2,250
1 cm.	200	400
2 cm.	50	100
3 cm.	22	45

sitting. From Tables 1 and 2 it is evident that with the beta applicator a very large amount of radiation is delivered at 1 mm. depth while only 2 per cent of this amount reaches a depth of 10 mm., whereas if gamma rays are used, 17 per cent of the amount delivered at 1 mm. reaches a depth of 10 mm.

Table 3 is a depth dose chart of two different voltages of x-ray. With x-ray the distribution of the irradiation is more homogeneous and the intensity on the surface is low when an adequate amount is delivered to the midline in the nasopharynx.

Figure 1 is an x-ray film showing a dummy beta radium applicator in place in the nasopharynx. The handle of the applicator was taped to the opposite side of the face in an attempt to force the radium against the lateral nasopharyngeal wall. After the location of the applicator in the midline was noted in this film, the applicator was placed in the same way in three other cases and x-ray films were made from the same position. In only one case of the four in which this method was used was the applicator successfully placed against the lateral pharyngeal wall. No attempt was made to shrink the turbinates, which perhaps was the reason for failure to place the radium in the proper position.

Figure 2 is an x-ray film taken with the dummy applicator in place and a silver catheter barely within the mouth of the eustachian tube. Care was taken not to extend the cannula up the tube. The radium-containing portion of the applicator is about

Figure 1.—Beta radium applicator in place in nasopharynx.

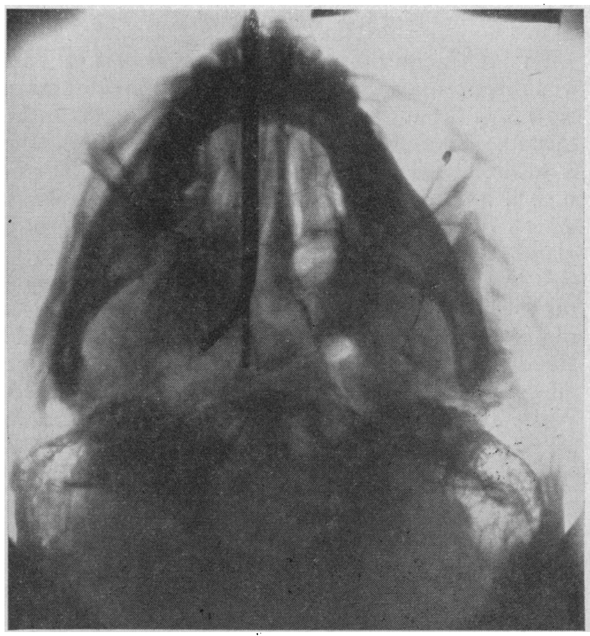


Figure 2.—Applicator in place and silver catheter barely within the mouth of the eustachian tube.

TABLE 3.—*Tissue Dose in Roentgens Corresponding to a Free Air Dose of 100 r at 50 cm. Focus Skin Distance.*

KVP	Filter	Area	Depth in Centimeters 0	1	3	5	7	10
140	0.25 mm. cu.	100 sq. cm.	138	134	109	81	61	39
200	0.5 mm. cu.	100 sq. cm.	136	133	109	82	63	31

1 cm. from the tip of the catheter which is barely within the orifice of the eustachian tube.

When the different types of irradiation are examined, it is apparent that for a very small amount of lymphoid tissue immediately surrounding the orifice of the eustachian tube the radium applicator would be the most desirable if it could be properly placed. Whether a filter of 0.3 mm. monel metal or one of 0.5 mm. platinum is better should be considered. If it were desirable to penetrate more than 2 or 3 mm., the platinum filter would be the more efficient. As the proponents of beta radiation state that the applicator is in actual contact with only half of the tissue to be treated, it would seem desirable to filter out the intense beta radiation. If that were done, the length of time for the application of radium would have to be greatly increased in order to deliver an effective dose.

If there is more than a very limited area of hypertrophied lymphoid tissue, other means than the present beta ray applicator would seem desirable. Morrison[8] described a new type of applicator with a flexible shaft designed so that the active radium-containing portion can be steered to the desired site. However, it would seem that considerable time might be needed to get the tip of the shaft in the proper position, and it would be difficult to be certain that the radium remained in the exact position desired. Also, if a large area were treated, the dose would be very irregular on the surface.

X-RAY IRRADIATION

The other means of irradiation is x-ray. This would seem to be the most logical if an area of more than 2 or 3 mm. away from the applicator is to be treated. There are two methods of application. One is to direct the ray through the side of the face in such a way as to cross-fire the nasopharynx. When this is done, the x-ray passes through the parotid gland and occasionally produces parotitis and usually some dryness of the mouth. These are temporary results and are not considered serious by most radiologists; no permanent damage to the parotid gland has been reported. The danger of damaging the growing mandible also has been considered. While such damage has been observed as a result of x-radiation of the mandible for tumor, only a small dosage is used for destruction of excess lymphoid tissue and no evidence of any damage to the bone has been reported.

The other method of applying x-radiation, and one which is advocated by Kerr,[6] is to put the cone into the patient's mouth and aim at the nasopharynx. Some radiologists use two fields, one to each side of the nasopharynx, while others use a single field to include both sides. Intraoral irradiation is very satisfactory if a large enough cone can be placed in the mouth and if the patient will hold his mouth and head in the proper position. When this approach is used, no x-ray reaches the parotid gland.

So far as the author has been able to determine, there are no reports of permanent damage in the nasopharynx following irradiation with the beta ray applicator. However, many radiologists feel that in cases in which the beta ray applicator is used there is a possibility that changes will occur later in life in the posterior nasopharyngeal wall because of the intense radiation to which that area is subjected in the course of treatment. When three applications of 12 minutes each are given at two-week intervals, a very large amount of radiation (13,300 r) is applied to the surface. Even though the entire applicator does not touch the surface, the points it does touch receive as much radiation as would be necessary to destroy a malignant lesion; and it is questionable that it is wise to submit the mucous membrane to such large dosage when there are methods of irradiating the lymphoid tissue which do not entail such intense radiation on the surface.

In choosing the kind of irradiation to be used, it is desirable to have accurate knowledge of the amount and location of the lymphoid tissue present. This information can best be supplied by an otolaryngologist who is skilled in the use of a nasopharyngoscope or a nasopharyngeal mirror. A lateral roentgenogram of the nasopharynx is of aid in determining the thickness of the lymphoid tissue on the posterior pharyngeal wall. It is considered advisable to remove the adenoid tissue surgically before irradiation is attempted. Fowler[4] advised operative removal of the adenoid tissue in the midline as this tissue prevents placement of the radium applicator in the proper position. A thorough examination of the hearing acuity should always be done by an otolaryngologist before radiologic treatment for impaired hearing is undertaken.

Recently there has been some difference of opinion as to the results obtained by irradiation. Guild's[5] conclusions on hearing acuity following irradiation differ from those of Crowe.[9] Guild expressed the opinion that accepted beliefs with regard to the effect of nasopharyngeal lymphoid tissue on hearing and with regard to the effectiveness of nasopharyngeal irradiation in treatment of impaired hearing need to be revised.

1831 Fourth Avenue.

REFERENCES

1. Braestrup, C. B.: Personal communication.

2. Bilchick, B., and Kolar, A. R.: Radium therapy for lymphoid tissue in the nasopharynx, The Annals of Otology, Rhinology and Laryngology, 59:78, March 1950.

3. Crowe, S. J.: Editor's note, Yearbook of Eye, Ear, Nose and Throat, page 494, 1949.

4. Fowler, E. P., Jr.: Irradiation of the eustachian tube, Archives of Otolaryngology, 43:1, Jan. 1946.

5. Guild, S. R.: Nasopharyngeal irradiation and hearing acuity, Laryngoscope, 60:55, Jan. 1950.

6. Kerr, H. D.: Personal communication.

7. Lederer, F. L.: Evaluation of irradiation of pharyngeal and nasopharyngeal lymphoid tissue, Annals of Otology, Rhinology and Laryngology, 50:102, March 1950.

8. Morrison, W.: Radium and the lymphoid tissue of the nasopharynx and pharynx, a new universal applicator, Archives of Otolaryngology, 50:300, Sept. 1949.

9. Proctor, D. F., Palvogt, L. M., and Crowe, S. J.: Irradiation of the lymphoid tissue in diseases of the upper respiratory tract, Bulletin of the Johns Hopkins Hospital, 83:383, Nov. 1948.

10. Quimby, E.: Quoted by Fowler.[4]

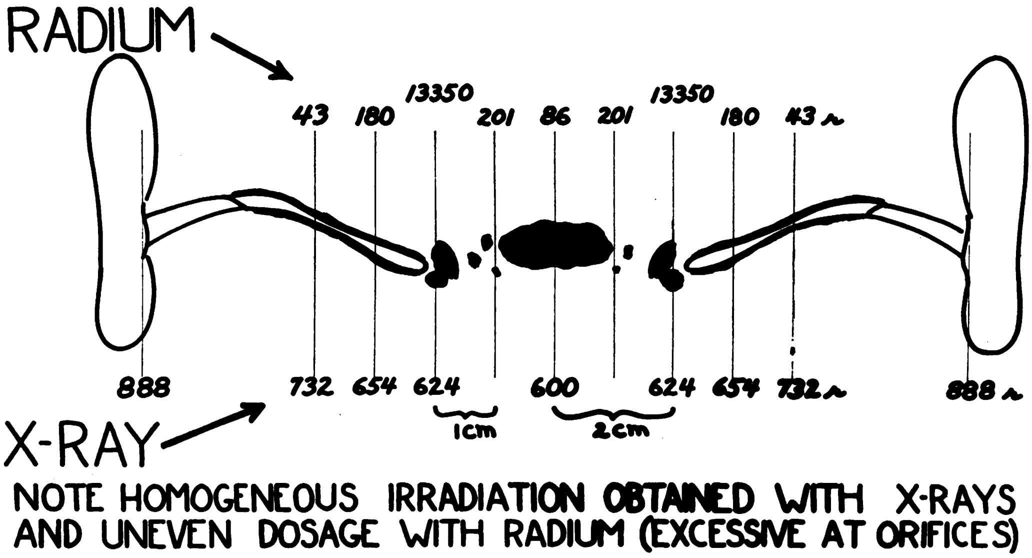
Discussion by SYDNEY F. THOMAS, M.D., *Palo Alto*

Graphic representation of the dosage levels from the monel filter type of radium applicator for the nasopharynx is recommended as they appeared in the exhibit of Drs. M. E. Mottram, H. A. Hill and L. H. Garland (see chart).

Technical difficulties in the measurement of beta rays have been one of the most difficult stumbling blocks in the assaying of the dosage of radiation from these monel-filtered radium applicators (beta applicators). And we now have the knowledge that the dosage, as it can be measured, is extremely high, as pointed out by Dr. Irwin in the substance of his paper.

The failure of many physicians to take cognizance of very small changes in distances radically affecting the dosage of radium is pointed out, and it is no wonder that cases are reported showing radiation ulcerations from too high a dosage for a benign disease. It is pointed out in the paper that this is above a cancerocidal dose.

COMPARATIVE DOSES FROM X-RAY AND RADIUM—FULL COURSE—FACTORS AS GIVEN BELOW*



* Factors:

X-ray: H.V.L. 1.0 mm. Cu. 50 sq. cm. field. 40 cm. F.S.D. 100 r in air to each side X6.

Radium: Standard monel metal applicators with 50 mg. radium at each orifice. Three treatments of 12 minutes each.